

certain amount of motion we can get a certain amount of heat." In the first place this form of statement is likely to give the impression that heat is something entirely different from motion, and in the second place it implies that heat and motion are quantitatively convertible, which is not strictly true. Further on the statement is made that in order to bring about chemical change "high heat must be used to aid the reaction."

A great number of similar expressions are to be found scattered throughout the book, and it seems a very short-sighted policy to sacrifice accuracy and the use of scientific modes of expression, even in attempting to make matters more intelligible to beginners, as it is far more difficult to get rid of early false impressions than to acquire correct ones in the first place. This sort of treatment is especially to be noticed in the author's account of the ionic theory. On p. 90, ions are first introduced very briefly to the notice of the student, and throughout the succeeding pages many reactions are represented as due to action between the ions; and equations are printed in which the ions are represented as atoms. This must be exceedingly confusing to the student who has been told in another place that atoms, generally speaking, cannot exist in the free state; and it is not until p. 417 that this difficulty is overcome for the student by the true explanation of the nature of an ion. Another serious misstatement occurs in the account of the phenomena of osmotic pressure, where, after quoting the extension of Avogadro's law to solutions, the following passage appears: "Notwithstanding the simplicity of this law, no practical method for determining molecular weight based upon it has yet been devised."

The more descriptive part of the book is also not free from inaccuracies. For example, in one portion of the table on p. 15 the atomic weights are referred to $H=1$, in another part of the same table to $O=16$. The term combining weight is itself used in two different senses in different parts of the book; in the earlier portion it is used as synonymous with atomic weight, and in the later portion as a simple submultiple of the latter. Another discrepancy is that which ascribes to krypton on p. 19 the atomic weight 81.8 and on p. 262 58.67. It is disappointing to find the author of so excellent a work as the admirable little book on organic chemistry failing to come up to the standard of accuracy which is now demanded of teachers.

HYDRAULICS.

A Treatise on Hydraulics. By Henry T. Bovey, M.Inst.C.E. Second edition, rewritten. Pp. xviii + 583. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1901.)

THE author of this treatise, in his position of professor of civil engineering and applied mechanics at McGill University, Montreal, has exceptional opportunities for conducting experimental investigations on the flow of water, owing to the remarkably complete equipment of the hydraulic laboratory under his charge, which the University owes, in addition to many other endowments, to the munificent liberality of Sir William C. McDonald, a well-known merchant residing in Montreal.

It is very satisfactory to note that Prof. Bovey has made full use of his opportunities in advancing the study of hydraulics, as indicated, in the first instance, by the publication of the first edition of this book in 1895; whilst this second edition, with its rearrangement, its large quantity of new matter, and its additional tables of experimental results, marks the progress which has been made in the interval towards raising the subject of hydraulics, so long based on empirical formulæ, into the position of an exact science.

The subject is divided into eight chapters, to each of which, in addition to examples worked out in the text, is appended a number of problems for the student, relating to the questions dealt with in the chapter, together with their answers. The book begins with a chapter on general principles and the flow through orifices and over weirs, followed by one on fluid-friction and pipe-flow, and another on the flow of water in open channels; and these three chapters, each extending over more than a hundred pages, complete the portion relating to the flow of water, and occupy more than half the book. They furnish a fairly exhaustive treatment of the subject; but though, owing to the large print, the widely-spaced formulæ, the numerous diagrams, and the tables, the actual contents of these chapters are not so great as might be inferred from the number of pages they occupy, the chapters are inconveniently long, and might with advantage have been subdivided. This is undoubtedly the portion of the book to which civil engineers engaged in water-works, irrigation, and river improvement will mainly refer for an elucidation of the difficulties involved in the correct determination of the flow of water through orifices, over weirs, along pipes, and in open channels. A chapter is devoted to the important subject of hydraulic machinery, including rams, presses, accumulators, and water-pressure engines. Three chapters relate to water-motors, dealing successively with impact, reaction, and the principles of impact and tangential turbines, vertical water-wheels, and turbines; and the final chapter deals with centrifugal pumps. The book is illustrated by three hundred and thirty figures in the text, mainly diagrams for elucidating the various theories and principles dealt with, together with a few drawings of machines referred to; whilst a very convenient paged list of the various headings of subjects throughout the book is given in the table of contents at the commencement, and a concise but useful index concludes the volume.

The mathematical treatment adopted right through, with the four hundred and forty-six examples given for working out, render the book more especially suitable for students in hydraulics who have had a previous mathematical training, the book having, indeed, been originally the outcome of a series of lectures to such students; and it will be doubtless of interest to hydraulicians, particularly in view of the advance it manifests in hydraulic science. A less elaborate and less educational method would probably have more favourably commended the book to the notice of practical engineers interested in hydraulic problems; and, in its present shape, the book seems likely, irrespective of its value to hydraulic students, to be mainly advantageous to those engineers

in practice who possess adequate mathematical knowledge and leisure to select from the numerous formulæ, and especially from the tables, those portions which are best adapted for practical application. It appears really almost impossible to produce a treatise on such a subject as hydraulics, so that, whilst furnishing an exhaustive treatment of the subject and being of considerable educational value for the advanced mathematical student, this book should, according to the author's hopes, at the same time prove specially adapted to the requirements of busy practical engineers; for in proportion as it realises its main object, it tends to become unsuited for its secondary purpose. Nevertheless, as a book tending largely to advance the science of hydraulics and promote the thorough training of future hydraulic engineers, it deserves to be very cordially welcomed.

OUR BOOK SHELF.

Erlebtes und Erstrebtes. Von Carl Gegenbaur. Mit einem Bildniss des Verfassers. Pp. 114. (Leipzig: Wilhelm Engelmann, 1901.) Price 2s.

THERE must be many who have hailed with delight the announcement of "*Erlebtes und Erstrebtes*," the authentic account of the long and assiduous life of the founder and elaborator of modern comparative anatomy. However, the readers of the little brochure will be sadly disappointed, since it contains not much *Erlebtes*, and the author is more than reluctant about telling us what he has "*Erstrebt*," i.e. striven for and reached. Most of the reminiscences can be of interest only to his own family. Born at Würzburg August 21, 1826, sprung from a family of mostly Governmental officials, mainly of Bavarian descent, Gegenbaur went through his schooling at Würzburg and spent the vacations roaming about with his gun, dissecting his spoil. He is emphatic about the value of the studies of the classics; "to ignore the classical languages means to resign part of our education, and those who say that these languages are dead, ought to remember that the letter killeth, but the spirit giveth life." Würzburg was also his university, where, after eighteen months of preliminary philosophical and historical studies, he was inscribed as a medical student. In the same year, 1847, Albert Koelliker was called to the university. F. Leydig was privat docent for microscopical anatomy, and for him our author has high praise. Another of his teachers was R. Virchow, "whose great merit is that he gave a new, very fertile, direction not only to pathology, but to the whole of anatomy, by imparting to it the notion of evolution."

Gegenbaur studied with a view to following natural sciences, not to devote himself to medicine, which latter he could not bring himself to consider a true science. Still, he became third assistant at the Julius hospital. In 1851 he took his degree, one of his theses dealing with the changes and variations of plants. Then followed his "*Wanderjahre*," visits to the chief German towns, and in Berlin he made the personal acquaintance of Joh. Mueller. In 1852 he went with Koelliker and Heinrich Mueller, of retina renown, to Messina, bent upon zoological research, and he wandered through Sicily, in which island he spent nearly a year.

In 1854 Gegenbaur established himself as privat docent for zoology at Würzburg, soon to leave this place for Jena as professor extraordinarius. At the death of Huschke he became the latter's successor as professor of anatomy. This was the first university in which henceforth anatomy was separated from physiology, a science for which he has not many kind words to say. Berlin

followed suit in the same direction after the decease of Joh. Mueller, then Würzburg, &c.

In 1856 he married his first wife, whom he was to lose soon after; we are not told that she was a daughter of Huschke. From this time dates the intimate friendship with Haeckel. The author speaks with warmth of quiet little Jena as the place where practically all his fundamental ideas were conceived and grew. He set himself to rescue anatomy from the state of mere description; the term morphology in opposition to physiology "was intended mainly to express the difference of treatment," and anatomy itself was to be elevated to a higher position by the comparative method.

In 1873 Gegenbaur went to Heidelberg as the successor of Fr. Arnold, his second father-in-law. The following twenty-nine years, so full of activity and world-wide influence, are dealt with in ten small pages—the writing of the text-book of the anatomy of man (now in its seventh edition), based upon the results of comparative anatomy; the starting of the long series of the "*Morphologische Jahrbuch*," and scanty reminiscences concerning, and of interest to, but a few intimate friends.

The book is prefaced with an excellent likeness of the author. H. G.

Beautiful Birds. By Edmund Selous. Pp. ix + 224. (London: Dent and Co., 1901.)

MR. SELOUS' volume, in spite of its pleasant-looking green cover, numerous though indifferent plates, and text cheerfully varied with italics, is in reality no more than an unduly swollen tract. It is necessary to say this at once, and with emphasis, lest the unwary buyer of bird books should add this volume to his library under the impression that he was adding a useful and chatty account of humming-birds and birds of paradise. The volume is, in fact, an example of what is known in the animal world as "aggressive mimicry." Under the guise of a pleasing discourse upon some of the more striking among many beautiful birds, the author really provides the public with not much more than a simple attack upon the wearing of birds' plumes by ladies. We have not the least objection to Mr. Selous' views in this matter, or to the expression of them. But he might surely have found one of those numerous journals which delight in denunciatory declamation rather than in adherence to frigid fact, and into its sympathetic columns have poured his feelings of horror at feminine inhumanity. Then no one would have been deceived about the matter, as some possibly may be. Mr. Selous builds upon a minimum of zoological fact a large superstructure of curiously agitated, almost hysterical, ethics. The book is, in its form, addressed to a hypothetical and female infant of tender years who is urged to persecute her mother and female relatives generally until they promise never to wear birds' feathers in their hats, as, for instance—"You must remind her of it from time to time ('remember mother you promised'), when you hear her talking about getting a new hat. And when you have made her promise about herself then you must make her promise never to let you wear a hat of that sort. . . . And if you have a sister very much older than yourself, &c., &c." With such observations the chapters are liberally sown and nearly invariably conclude; it is, moreover, at least once added that the mother and sisters in question had better read this particular volume. We sincerely hope that they won't take this broad and business-like hint; for even from the point of view of a "humanitarian" (we must use inverted commas as there is no necessary connection between the use and meaning of this term) Mr. Selous is unworthy of praise. Why should he select the "*beautiful birds*" only, and by implication condone the massacre of birds that have not that advantage?

F. E. B.